Digital Wireless Transmission of Live Video

Wright State High Altitude Balloon Team

FINAL PRESENTATION

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Outline

- Goals
- Design
- Results
- Balloon Launch
- Conclusion

Initial Goal

- Achieve real-time video transmission from the high altitude balloon via a standalone software-defined radio.

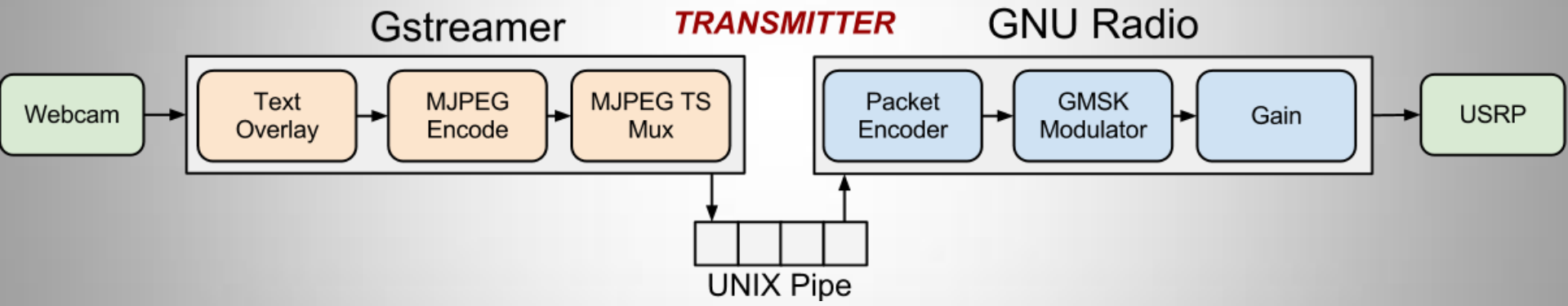
Design: RF

- The FCC requires the RF signal path for the operating frequency to be above 420 MHz
- Operating frequency is 1280.5 MHz
- Optimum performance is at line of sight conditions
- 20 dB amp is used with the E100 (+20dbm output)
- Yagi antenna: RX (14 dB gain)
- ¾ wavelength whip antenna: TX (1:1 unity gain)

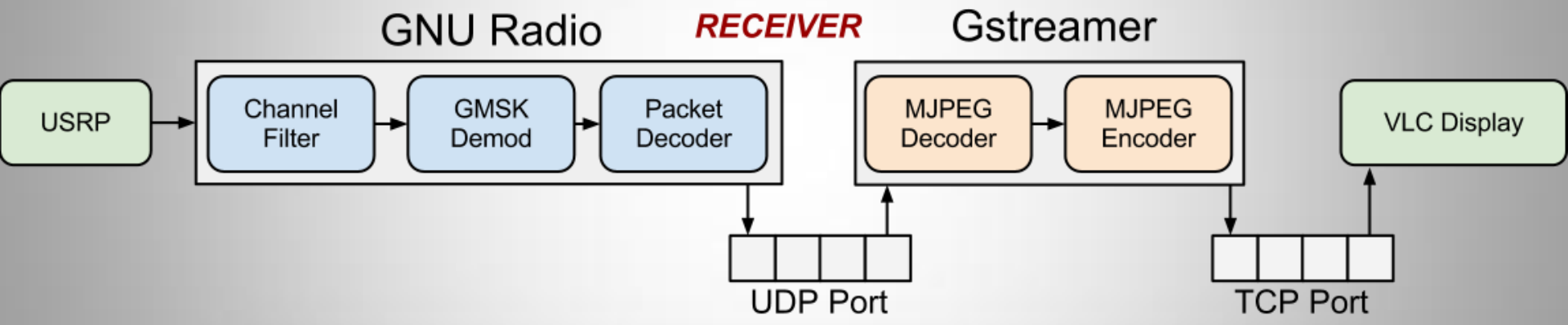
Design: Path Loss

- The balloon altitude of 100,000 feet = 30.4 km
- FSPL(dB) = 20*log(Frequency(MHz) + 20*log(distance(km)) + 32.44
- Transmission frequency of 1280.5 MHz yields 120 dB of signal path loss
- The signal strength of the transmitted signal at 1280.5 MHz with the 20 dB amplifier is +20 dBm output
- The signal level under line of sight ideal conditions is +20-120 = -100 dBm at the receiver, which is 25 to 30 dB above noise floor
- The Yagi antenna adds 14 dB gain making the received signal at 100,000 feet to be 30 to 44 dB above noise floor

Design: Standalone SDR Transmitter



Design: SDR Receiver



Design: Parts List

	Price
11.1V 6600 ma/Hr Lithium-Ion Batter Pack	69.99
11.1V 4400 ma/Hr Lithium-Ion Battery Pack	45.99
Life Cam HD-5000 Web Cam	40.95
Castle Creations CC-CEB Pro Battery Eliminator Circuit	40.99
E100 (Software Defined Radio)	1300.00
EC3 Connectors	3.99
Total	**$1510.91**

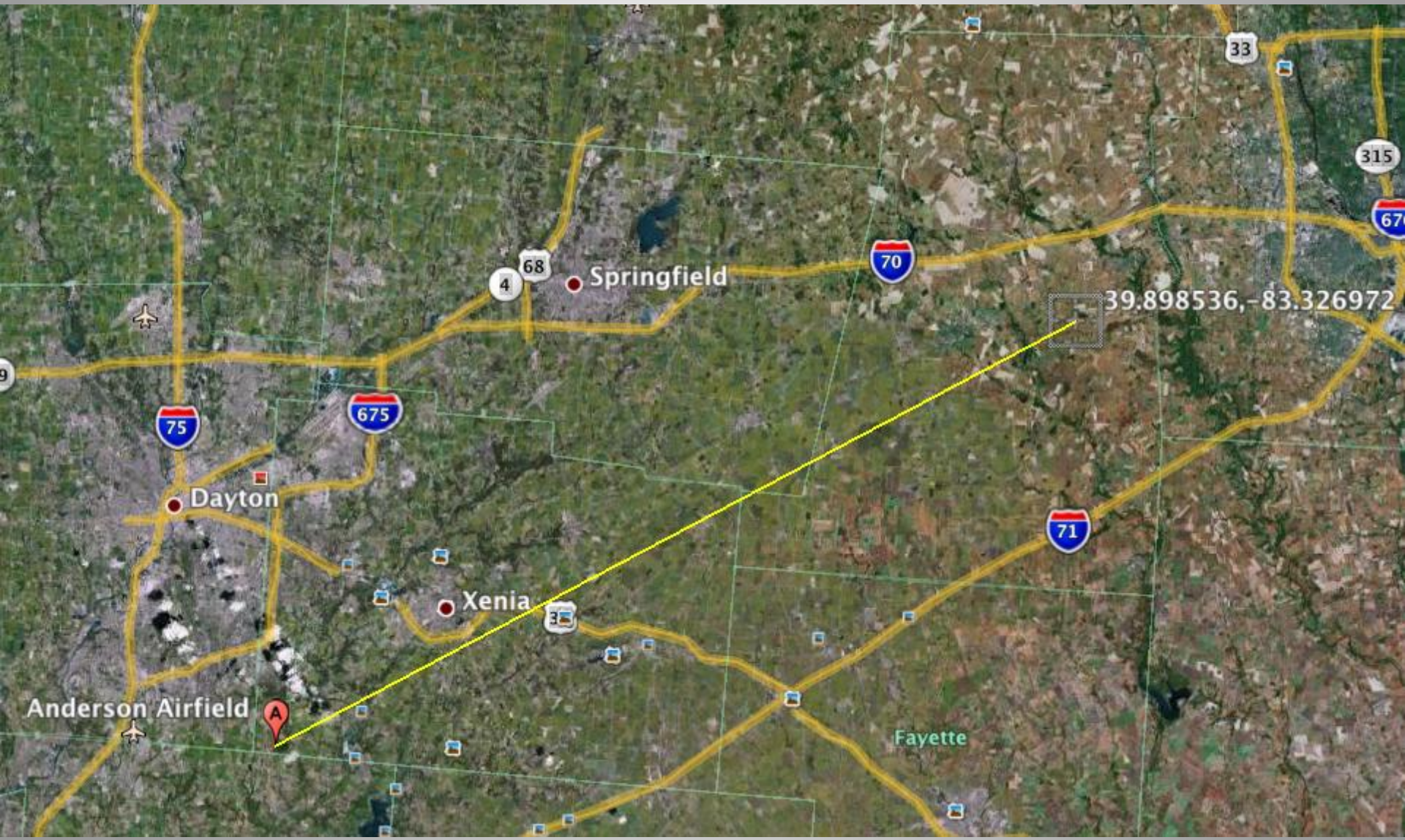
Results: Ground Testing

- Basic waveforms, small text & audio files at 3 ft
- Live video streaming at 3 ft in lab
- Live video streaming at 100 ft in Russ hallway
- Live video streaming at 700 ft in Joshi parking lot
- Live video streaming at 2,800 ft along Colonel Glenn Hwy
- Live video streaming at 25,000 ft (4.7 miles) from Wright Memorial to N/E side of WPAFB

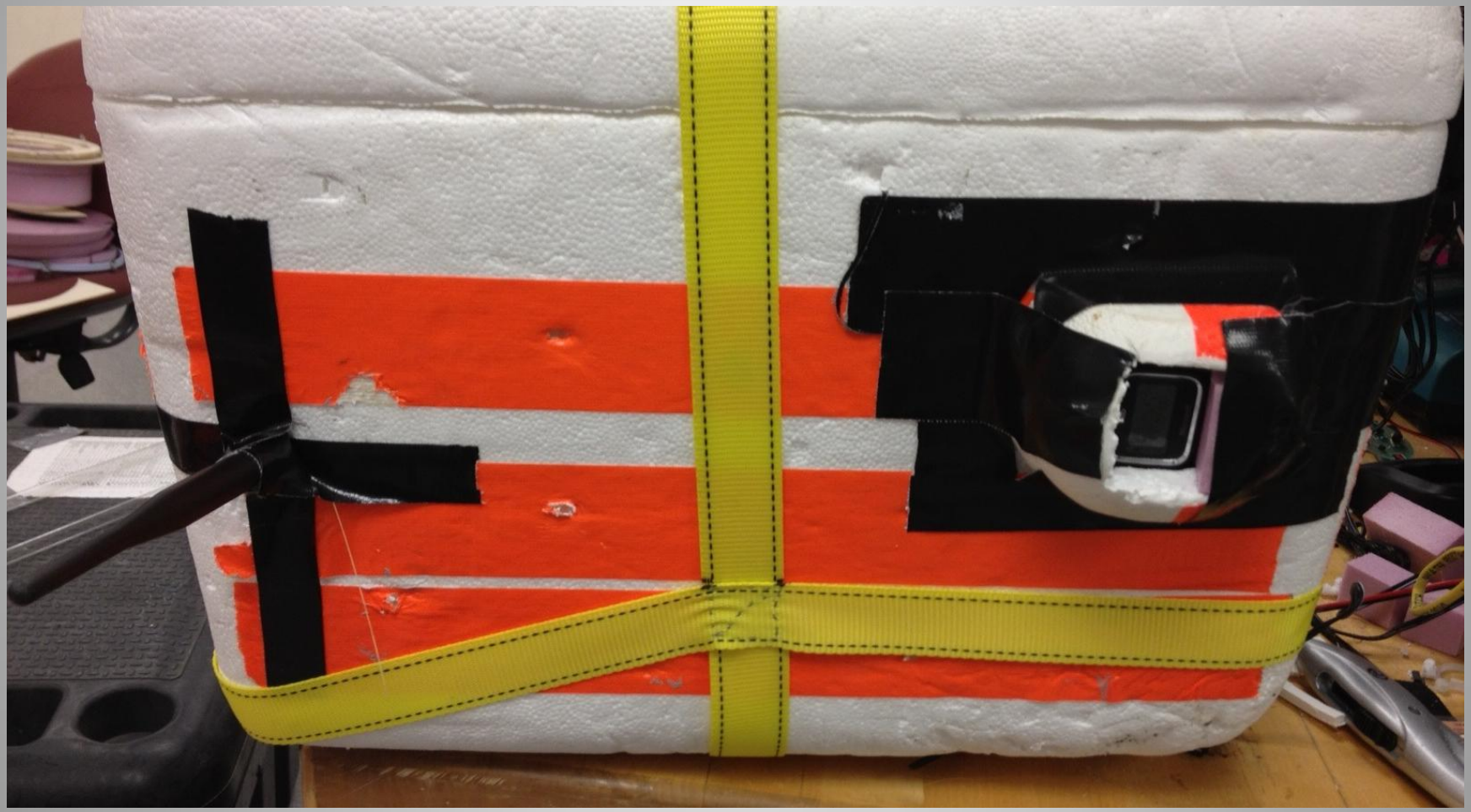
Balloon Launch 29

- Thursday, May 31st, 2012
- Launched from Anderson Airfield (south of Bellbrook)
- Two packages
  - Command Package for tracking & communication
  - Video Package for video capture & transmission
- Successful launch and recovery
- **Successfully received live video to 60,000 feet!**

Balloon Launch 29



Balloon Launch 29



Balloon Launch 29

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Conclusion

- Team Live Video has successfully met our goal
- Improvements necessary for future designs
  - Must obtain better E100 performance by moving processing to the FPGA or upgrading the hardware
  - Build Yagi receiving antenna with better precision
  - Optimize video encoding/decoding to achieve better performance and robustness
- Could use antenna on roof of Russ for receiving
- Launching high altitude balloons are a lot of work!

End

Any Questions?